The Influence of Ground Water on Nitrogen Delivery to the Chesapeake Bay

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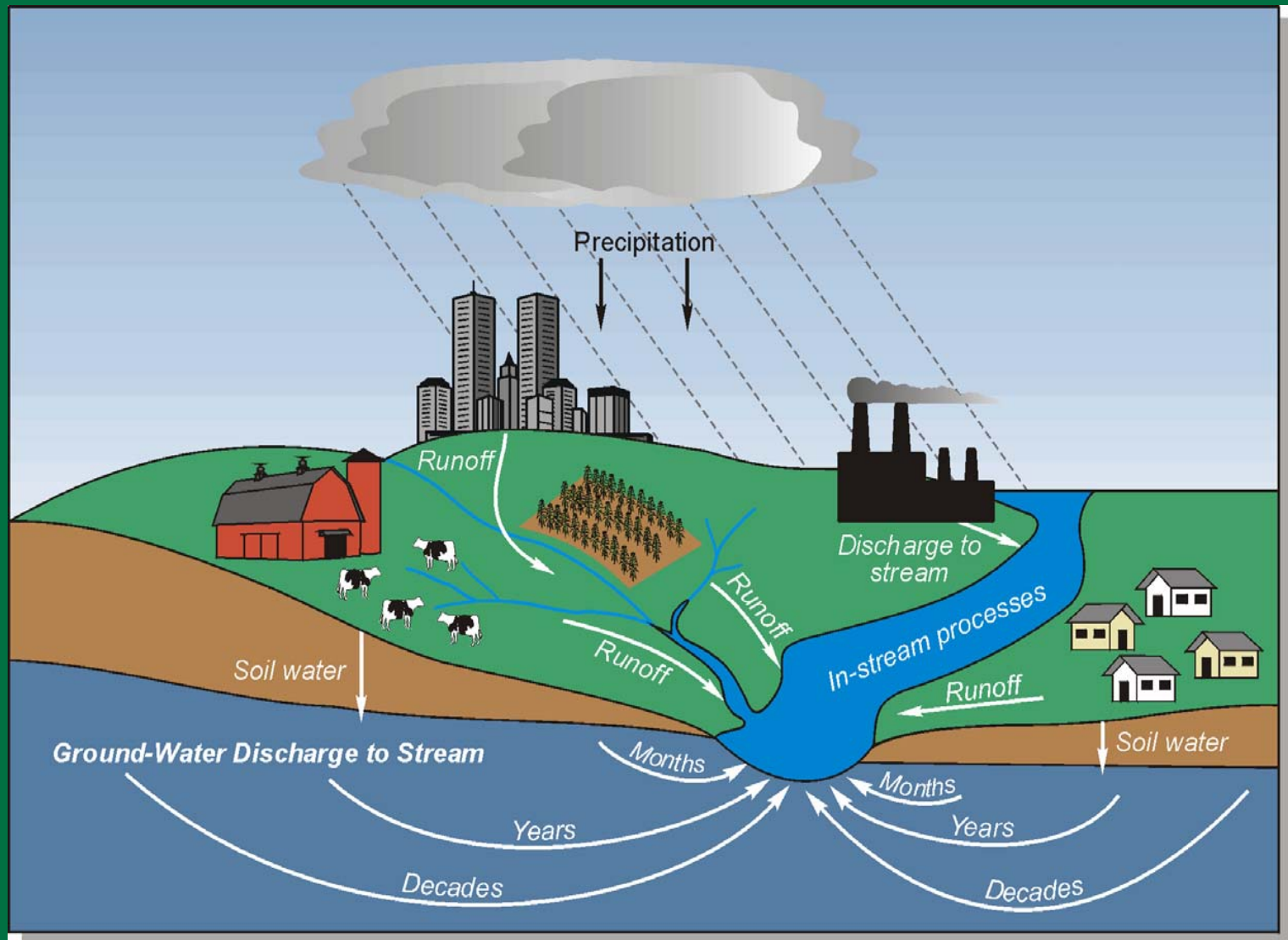
February 22, 2006

USGS

USGS Ground-Water Studies

- Discharge
- Nitrate load
- Age
- Factors
- “Lag time”



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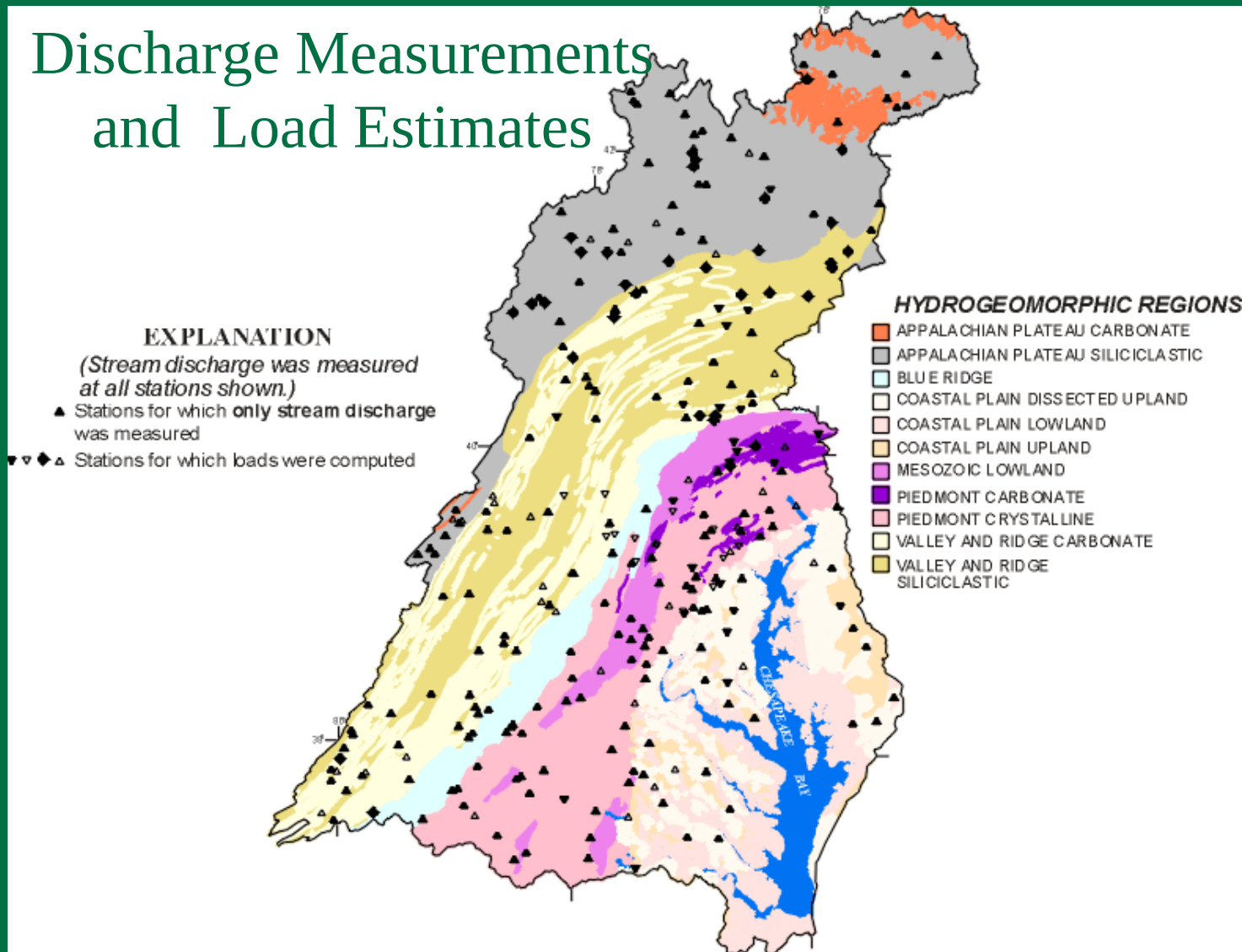
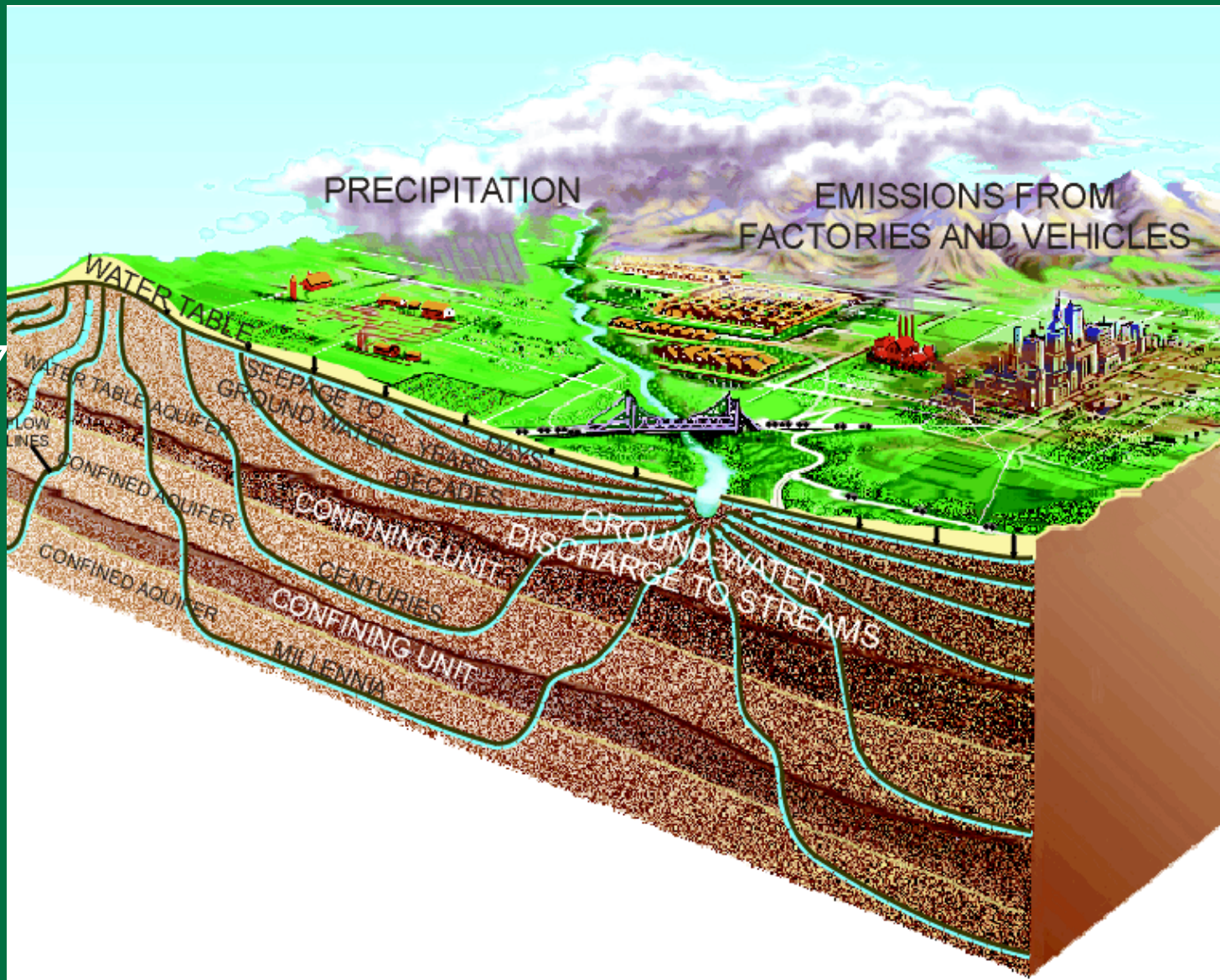
Ground-Water Discharge to Streams

- Contributes about 50 percent of the stream flow
- Range of 16 to 92 percent
- Influence of rock type



Ground-water loads to streams

- About half of nitrogen in stream delivered through ground water
- Varies from 17 to 80 percent
- Influence of land use
- Denitrification
- Timing of delivery



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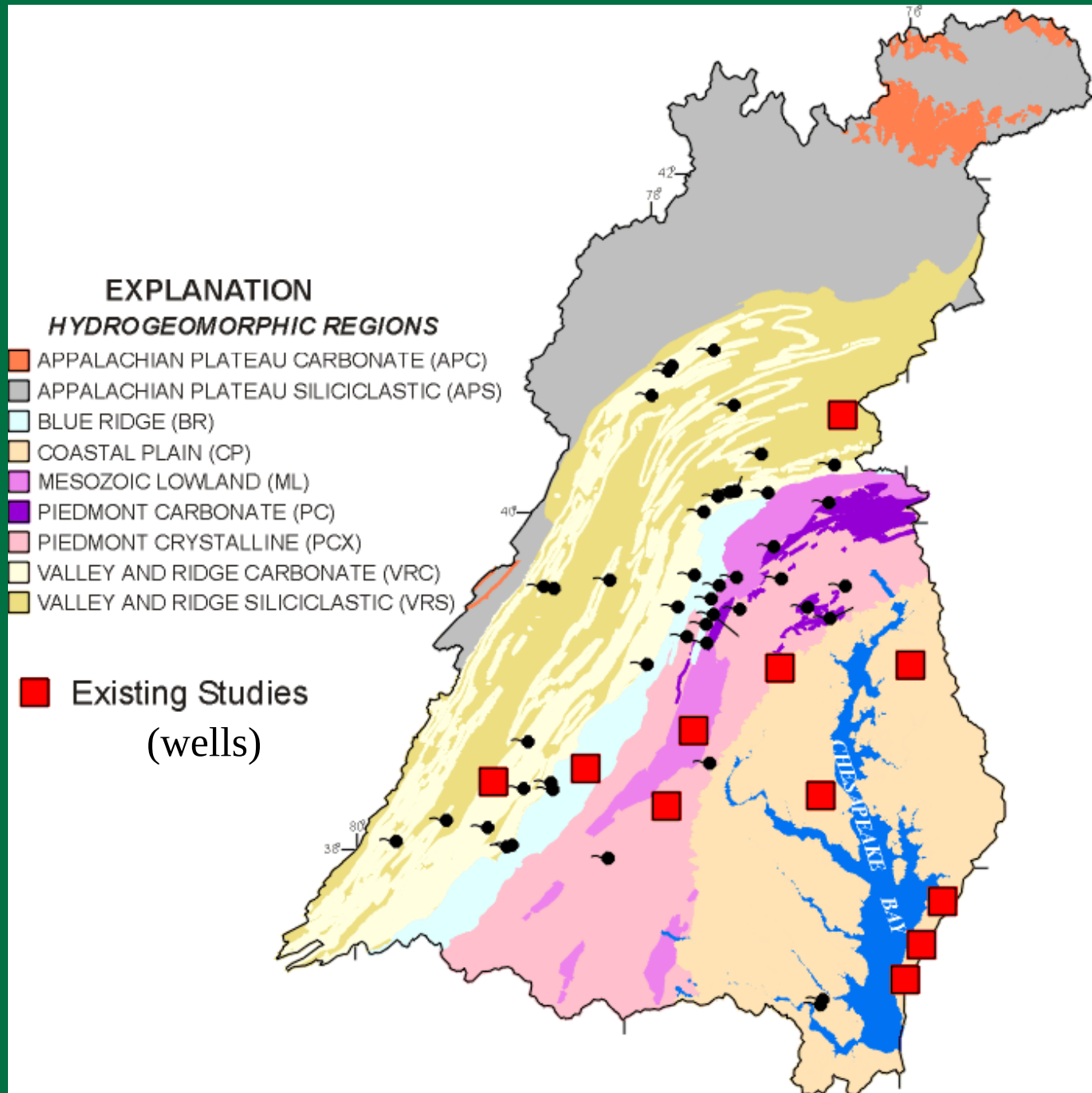
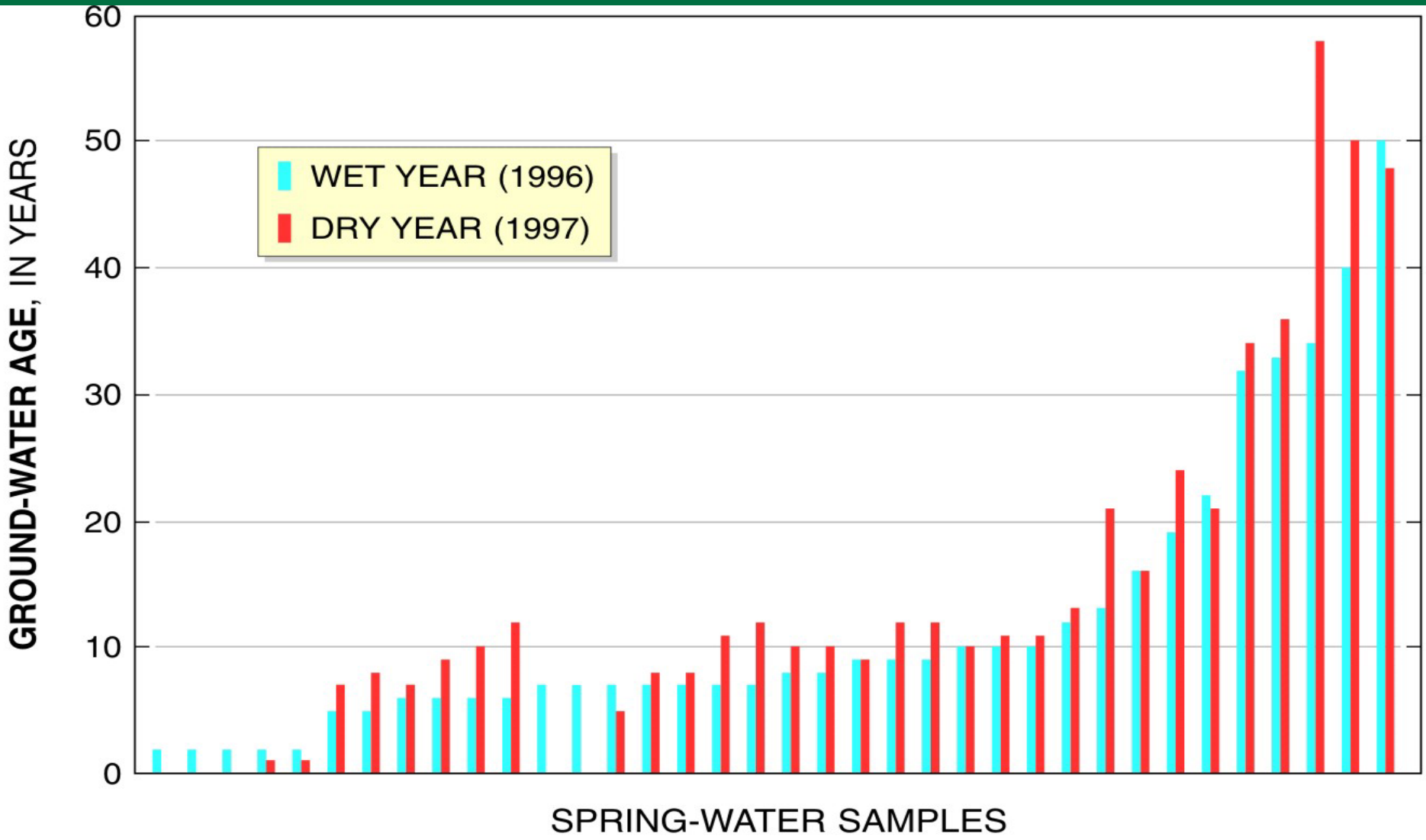
Ground-Water Ages

- Springs
- Watersheds
- Tracers
- Models

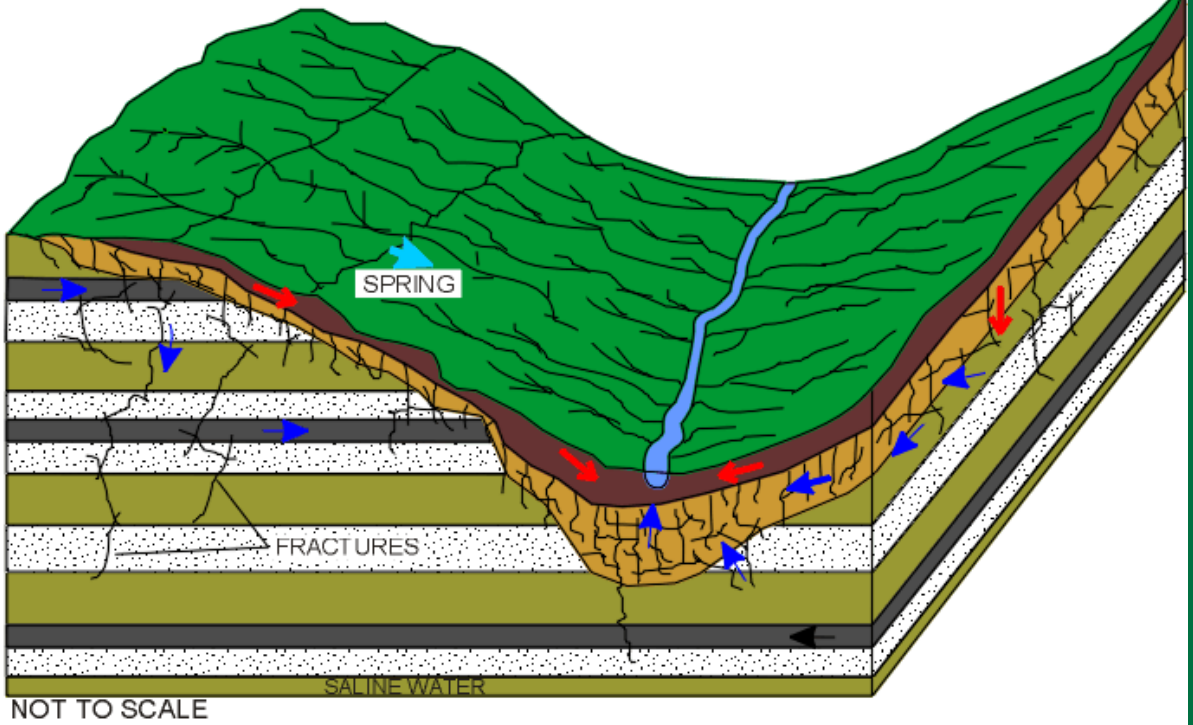


Ground-Water Ages from Springs



Ground-Water Ages and Watersheds

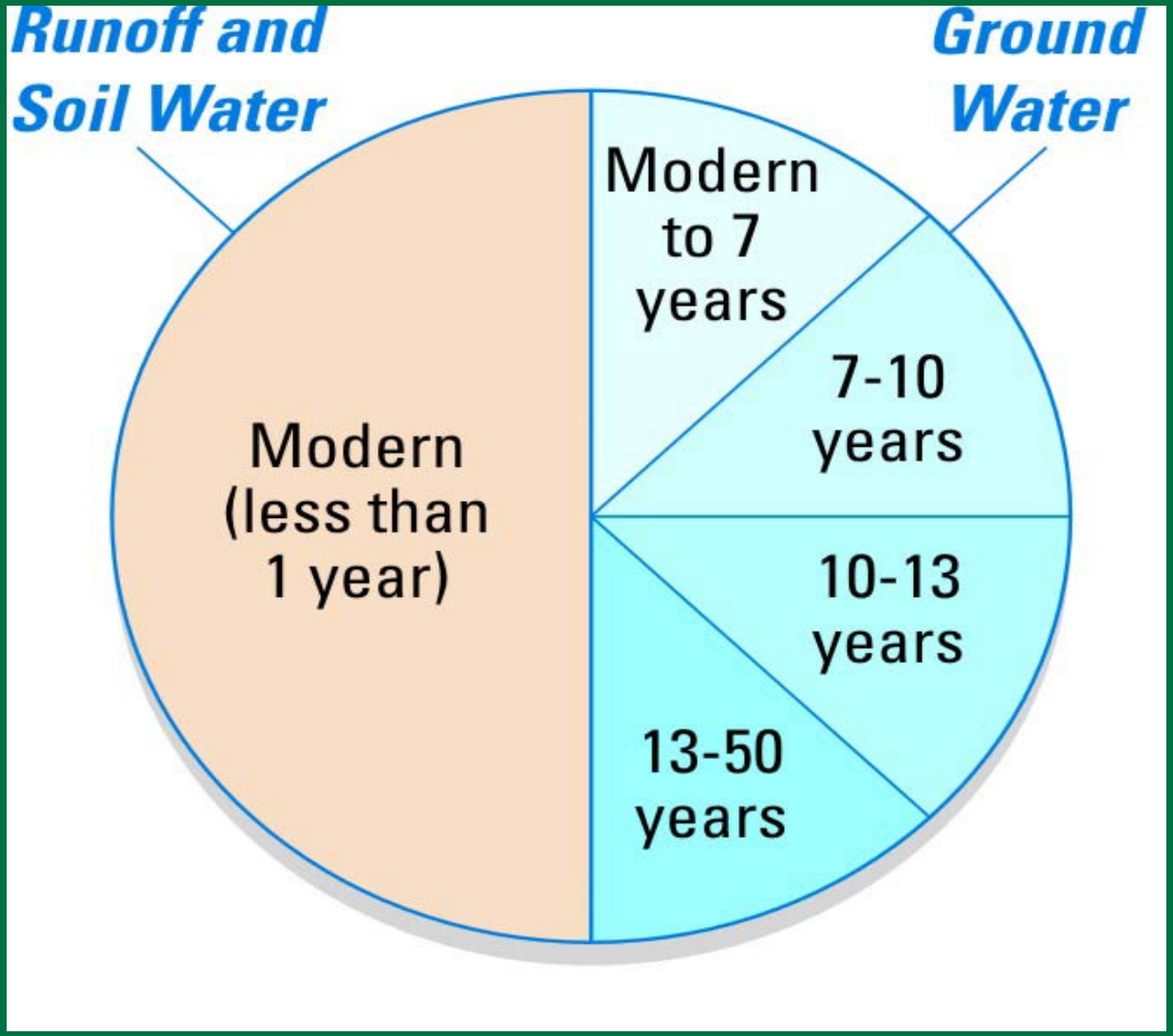
- Mixture of ages to streams
- Ranges similar to springs
- Affected by recharge area, properties of aquifer and gradient



(modified from Harlow and LeCain, 1991).

Ages of water to a stream

- Large component of “modern water”
  - Runoff and soil water
- Ground water
  - 10 year average
  - 75 % of all water less than 13 years
- Almost 90% of water less then 13 years old



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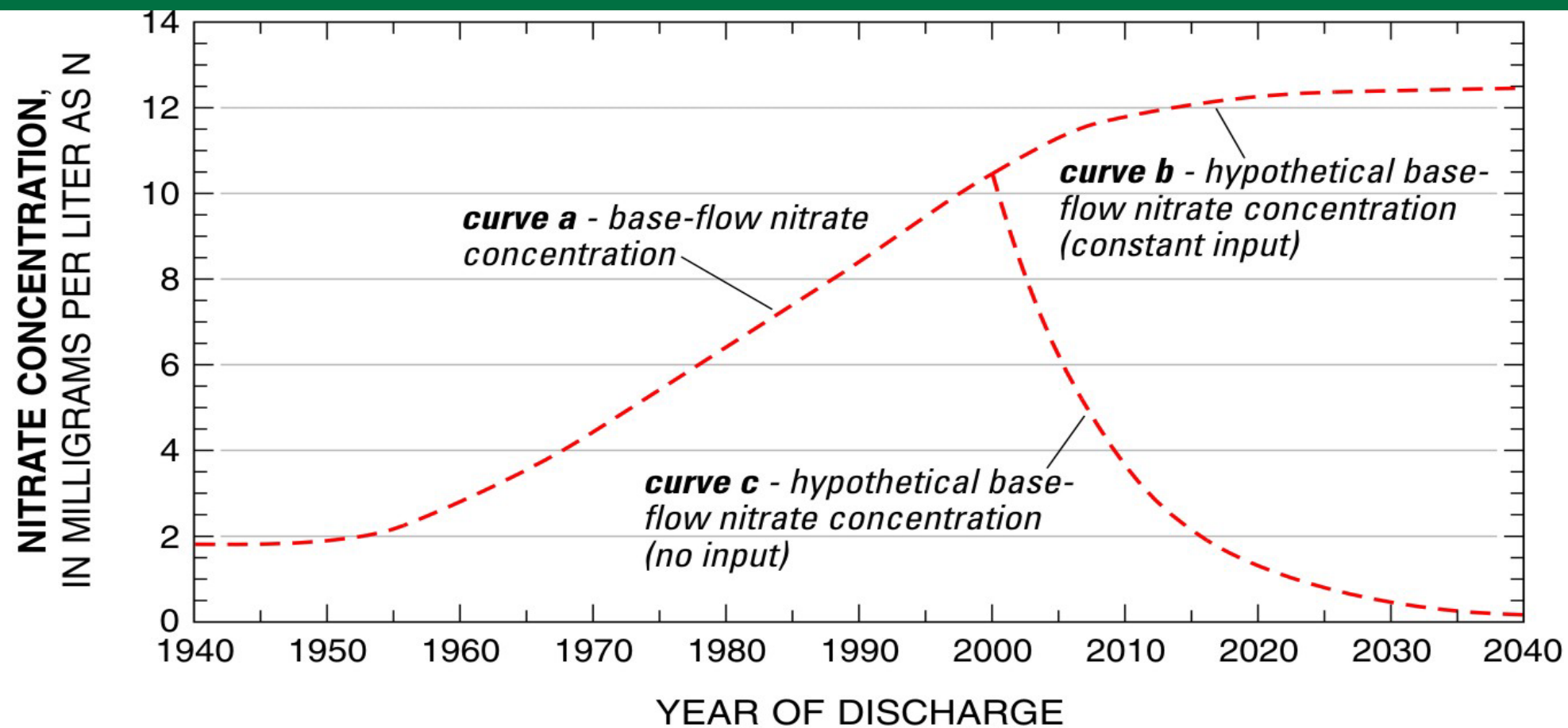
Potential Changes of Nitrate in Streams



Implications

- Meeting water-quality criteria by 2010 will be difficult.
  - Rate of source reduction and retention
  - Influence of environmental factors
- Need to increase rate of, and better “target”, nitrogen source reduction and retention.
  - Use denitrification to reduce nitrogen delivery to streams
  - Priority on “headwater” streams
  - Reduce nitrogen in winter and spring
- Ground water will cause some delay in improvement of water quality.
  - There will still be initial improvements with much of delay less than a decade
- Working to enhance watershed models and monitoring to better predict and explain improvements in streams.

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